

WHAT IS CLAIMED IS:

- 1           1. A process for the oxidation of an olefin  
2           comprising three or more carbon atoms, wherein the  
3           process comprises:  
4           reacting the olefin with oxygen to form a  
5           reaction mixture in the presence of a catalyst  
6           composition comprising:  
7           silver; and,  
8           a promoter comprising potassium and a promoter  
9           comprising rhenium  
10          deposited on an  $\alpha$ -alumina carrier, wherein the  
11          potassium promoter provides potassium at a  
12          concentration of up to 120  $\mu$ mole per gram of  
13          catalyst composition.
- 1           2. The process of claim 1, wherein the potassium  
2           promoter provides potassium at a concentration of  
3           from 12  $\mu$ mole to 100  $\mu$ mole per gram of catalyst  
4           composition and the rhenium promoter provides  
5           rhenium at a concentration of from 3  $\mu$ mole to 20  
6            $\mu$ mole per gram of catalyst composition.
- 1           3. The process of claim 2, wherein the  $\alpha$ -alumina  
2           carrier has a BET surface area of 0.1 m<sup>2</sup>/g to 25  
3           m<sup>2</sup>/g, and an apparent porosity of from 0.1 ml/g to  
4           1.2 ml/g.

- 1        4. The process of claim 1, wherein the  $\alpha$ -alumina  
2        carrier comprises at least 60 %w  $\alpha$ -alumina.
- 1        5. The process of claim 1, wherein the  $\alpha$ -alumina  
2        carrier has a pore size distribution such that the  
3        pores with diameters in the range of from 0.2  $\mu\text{m}$   
4        to 10  $\mu\text{m}$  comprise more than 75 % of the total pore  
5        volume; the pores with diameters greater than 10  
6         $\mu\text{m}$  comprise less than 20 % of the total pore  
7        volume; and the pores with diameters less than 0.2  
8         $\mu\text{m}$  comprise less than 10 % of the total pore  
9        volume.
- 1        6. The process of claim 1, wherein the  $\alpha$ -alumina  
2        carrier has a water absorption of at least 0.35  
3        ml/g and a surface area in the range of from 1.0  
4         $\text{m}^2/\text{g}$  to 5  $\text{m}^2/\text{g}$ .
- 1        7. The process of claim 1, wherein the  $\alpha$ -alumina  
2        carrier is based on:  
3        (a) from 50 %w to 90 %w of a first particulate  $\alpha$ -  
4        alumina having an average particle size of from  
5        more than 10  $\mu\text{m}$  up to 100  $\mu\text{m}$ ; and,  
6        (b) from 10 %w to 50 %w of a second particulate  $\alpha$ -  
7        alumina having an average particle size of from 1  
8         $\mu\text{m}$  to 10  $\mu\text{m}$ ; said %w being based on the total  
9        weight of  $\alpha$ -alumina in the mixture.

1 8. The process of claim 1, wherein the  $\alpha$ -alumina carrier  
2 comprises:

3 (a) from 65 %w to 75 %w, relative to the total  
4 weight of  $\alpha$ -alumina in the mixture, of a first  
5 particulate  $\alpha$ -alumina having an average particle size of  
6 from 11  $\mu$ m to 60  $\mu$ m;

7 (b) from 25 %w to 35 %w, relative to the total  
8 weight of  $\alpha$ -alumina in the mixture, of a second  
9 particulate  $\alpha$ -alumina having an average particle size of  
10 from 2  $\mu$ m to 6  $\mu$ m;

11 (c) from 2 %w to 5 %w of an alumina hydrate,  
12 calculated as aluminum oxide relative to the total weight  
13 of  $\alpha$ -alumina in the mixture;

14 (d) from 0.2 %w to 0.8 %w of an amorphous silica  
15 compound, calculated as silicium oxide relative to the  
16 total weight of  $\alpha$ -alumina in the mixture; and,

17 (e) from 0.05%w to 0.3 %w of an alkali metal  
18 compound, calculated as the alkali metal oxide relative  
19 to the total weight of  $\alpha$ -alumina in the mixture.

1 9. The process of claim 1 wherein the reaction  
2 mixture further comprises an organic chloride promoter.

1 10. The process of claim 9 wherein the organic  
2 chloride is present at a concentration of at least 50 ppm  
3 by volume.

1           11. The process of claim 9, wherein the reaction  
2 mixture further comprises a NO<sub>x</sub> promoter, wherein x is 1  
3 or 2.

1           12. The process of claim 9, wherein the NO<sub>x</sub> promoter  
2 is present at a concentration of at least 10 ppm by  
3 volume.

1           13. A catalyst composition for the oxidation of an  
2 olefin comprising three or more carbon atoms,  
3 wherein the catalyst composition comprises:  
4           silver; and,  
5           a promoter comprising potassium and a promoter  
6           comprising rhenium  
7           deposited on an α-alumina carrier, wherein the  
8           potassium promoter provides potassium at a  
9           concentration of from 8 μmole to 120 μmole per  
10          gram of catalyst composition.

1           14. The catalyst of claim 13, wherein the rhenium  
2 promoter provides rhenium at a concentration of from  
3 1 μmole to 30 μmole per gram of catalyst  
4 composition.

1           15. The catalyst of claim 13, wherein the carrier  
2 comprises an α-alumina carrier is based on:

3           (a) from 50 %w to 90 %w of a first particulate α-  
4 alumina having an average particle size of from more than  
5 10 up to 100 μm; and,

6 (b) from about 10 %w to about 50 %w of a second  
7 particulate  $\alpha$ -alumina having an average particle size of  
8 from 1  $\mu\text{m}$  to 10  $\mu\text{m}$ ; and wherein said %w is based on the  
9 total weight of  $\alpha$ -alumina in the mixture.

1 16. The catalyst of claim 13, wherein  $\alpha$ -alumina  
2 carrier has a pore size distribution such that pores with  
3 diameters in the range of from 0.2  $\mu\text{m}$  to 10  $\mu\text{m}$  represent  
4 more than 75 % of the total pore volume; pores with  
5 diameters greater than 10  $\mu\text{m}$  represent less than 20 % of  
6 the total pore volume; and pores with diameters less than  
7 0.2  $\mu\text{m}$  represent less than 10 % of the total pore volume.

1 17. The catalyst composition of claim 13, wherein  
2 the  $\alpha$ -alumina carrier has a water absorption of at least  
3 0.35 ml/g and a surface area in the range of from 0.6m<sup>2</sup>/g  
4 to 5 m<sup>2</sup>/g.

1 18. The catalyst of claim 13, wherein the carrier  
2 comprises an  $\alpha$ -alumina carrier having a composition  
3 comprising:

4 (a) from 65 %w to 75 %w, relative to the total  
5 weight of  $\alpha$ -alumina in the mixture, of a first  
6 particulate  $\alpha$ -alumina having an average particle size of  
7 from 11  $\mu\text{m}$  to 60  $\mu\text{m}$ ;

8 (b) from 25 %w to 35 %w, relative to the total  
9 weight of  $\alpha$ -alumina in the mixture, of a second  
10 particulate  $\alpha$ -alumina having an average particle size of  
11 from 2  $\mu\text{m}$  to 6  $\mu\text{m}$ ;

12           (c) from 2 %w to 5 %w of an alumina hydrate,  
13 calculated as aluminum oxide relative to the total weight  
14 of  $\alpha$ -alumina in the mixture;

15           (d) from 0.2 %w to 0.8 %w of an amorphous silica  
16 compound, calculated as silicium oxide relative to the  
17 total weight of  $\alpha$ -alumina in the mixture; and

18           (e) from 0.05 to 0.3 %w of an alkali metal compound,  
19 calculated as the alkali metal oxide relative to the  
20 total weight of  $\alpha$ -alumina in the mixture.